UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P O. Box 1450
Alexandria, Virginia 22313-1450
www uspto gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/605,108 | 09/09/2003 | Dureseti Chidambarrao | FIS920030183US1 | 2107 |

7590 03/28/2008

Andrew M. Calderon
Greenblum and Bernstein P.L.C.
1950 Roland Clarke Place
Reston, VA 20191

| EXAMINER | |
|---|---|
| PHAM, LONG | |
| ART UNIT | PAPER NUMBER |
| 2814 | |
| MAIL DATE | DELIVERY MODE |
| 03/28/2008 | PAPER |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

UNITED STATES PATENT AND TRADEMARK OFFICE

---

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

---

*Ex parte* DURESETI CHIDAMBARRAO and
OMER H. DOKUMACI

---

Appeal 2008-1439
Application 10/605,108
Technology Center 2800

---

Decided: March 28, 2008

---

Before EDWARD C. KIMLIN, PETER F. KRATZ, and
MICHAEL P. COLAIANNI, *Administrative Patent Judges*.

KRATZ, *Administrative Patent Judge*.

DECISION ON APPEAL

1This is a decision on an appeal from the Examiner's final rejection of claims 16-18, 22-28, and 30-39. We have jurisdiction pursuant to 35 U.S.C. § 6.

Appellants' invention is directed to a method of reducing diffusion of N-type impurities in a SiGe substrate. Source and drain extension regions are formed in an upper surface of the substrate and ion implantation of an interstitial element (e.g., Si or O) into the source and drain extension regions is performed: (1) in a manner such that low-vacancy regions are formed at regions that substantially overlaps the source and drain extension regions; and/or (2) after gate electrode sidewalls are formed (Specification ¶¶ 0005-0007, and 0010). Alternatively, ion implantation is conducted in a manner such that vacancy concentration in the source and drain extension regions is reduced after sidewall formation via an ion implantation that annihilates excess vacancies or traps vacancies so as to form low vacancy regions that substantially overlap the source and drain extension regions. In the latter alternative, the ion implantation can involve implanting of a vacancy-trapping element or an interstitial element, as disclosed by Appellants (Specification ¶¶ 0010-0011). Claims 16 and 39 are illustrative and reproduced below:

> 16. A method for reducing diffusion of an N type impurity in a SiGe-based substrate, the method comprising steps of:
>
> forming source and drain extension regions in an upper surface of the SiGe-based substrate; and
>
> ion implanting an interstitial element into the source and drain extension regions to reduce vacancy concentration in the source and drain extension regions and to form low-vacancy regions that substantially overlap the source and drain extension regions.

39. A method for reducing diffusion of an N type impurity in a SiGe substrate, the method comprising steps of:

forming an Si cap layer on the SiGe substrate;

forming a gate electrode on the Si cap layer;

forming sidewalls on sides of the gate electrode;

forming source and drain extension regions in an upper surface of the SiGe substrate; and

reducing a vacancy concentration in the source and drain extension regions using ion implantation in order to annihilate excess vacancies or trap vacancies,

wherein the reducing occurs after the sidewalls are formed and forms low-vacancy regions that substantially overlap the source and drain extension regions.

In addition to alleged admittedly available prior art (AAPA) set forth in the Background section of the subject Specification, the Examiner relies on the following prior art reference as evidence in rejecting the appealed claims:

| | | |
|---|---|---|
| Yoo | 6,200,836 B1 | Mar. 13, 2001 |

Claims 16-18, 22-28, and 30-39 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the AAPA in view of Yoo.

We reverse the stated obviousness rejection. The Examiner bears the initial burden of presenting a prima facie case of obviousness. *In re Oetiker,* 977 F.2d 1443, 1445 (Fed. Cir. 1992). Here, the Examiner has not discharged this burden for reasons set forth in the Brief and Reply Brief.

Accordingly, we reverse the obviousness rejection presented by the Examiner.

All of the appealed claims are drawn to a method of preventing diffusion of N-type impurities in a SiGe based substrate via source/drain region extension formation and specified ion implantation techniques, as detailed in the appealed claims.

In rejecting the appealed claims, the Examiner relies on asserted AAPA in the Background of the Invention section of Appellants' Specification as acknowledging the prior art formation of source/drain regions in a SiGe based substrate (Ans. 2). The Examiner notes that the AAPA does not teach (1) forming source and drain extension regions in the upper surface of the SiGe substrate and (2) ion implantation of an interstitial element (or other ion implantation element) that is conducted in a way to reduce vacancy concentration in the source/drain extension regions and form low vacancy regions as recited in the appealed claims (Ans. 3).

The Examiner turns to Yoo for allegedly teaching "source and drain extension regions 16, 18 in the upper surface of a substrate and ion implanting interstitial element or oxygen into the source and drain extension regions to prevent increase of threshold voltage" (Ans. 3).

In light of the teachings of Yoo, the Examiner maintains that it would have been obvious to one of ordinary skill in the art at the time of the invention to add the source and drain extension region formation and ion implanting step according to Yoo to a process for forming a SiGe based substrate with source and drain regions of the AAPA to obtain the threshold voltage increase prevention taught by Yoo. *Id.*

In so doing, the Examiner asserts that the claimed method of formation of low vacancy regions that substantially overlap the source and drain extension regions (claims 16-18, 22-28, 30-37, and 39) and the claimed reduction in vacancy concentration in the source and drain extension regions (claims 16-18, 22- 28, and 30-39) would inherently result from a process conducted according to the combined teachings of the AAPA and Yoo.[1] Concerning claim 38, the Examiner also maintains, *inter alia*, the AAPA in combination with Yoo teach that "the ion implantation occurs after the side walls are formed" (Ans. 4).

Appellants, on the other hand, maintain that the Examiner has not presented a prima facie case of obviousness. As correctly explained by Appellants, Yoo does not disclose an SiGe substrate and the Examiner has not established that Yoo performs the oxygen implant taught therein in a manner corresponding to Applicants' disclosed method of interstitial element implantation or ion implantation so as to establish a reasonable basis for the examiner's inherency theory based on the proposed modified teachings of the AAPA. Hence, assuming arguendo that the Examiner's characterizations of the AAPA are correct, Appellants maintain, *inter alia*, that the Examiner has not established that the combination thereof with Yoo would inherently result in the here-claimed process. We agree with Appellants, on this record.

In this regard, the Examiner is basically taking Appellants' disclosed background alleged AAPA and asserting an inherency theory in support of the proposed modification of the AAPA to reach that which Appellants present as an improvement over the AAPA. However, the Examiner's obviousness rejection is predicated on an inherency theory

[1] Of the rejected claims, claims 16, 38, and 39 are the only independent claims.

without the provision of adequate objective evidence or technical reasoning furnished by the Examiner to show the requisite support for the obviousness plus inherency argument/theory presented.

For example, Appellants maintain that Yoo discloses oxygen implantation at a dose of about an order of magnitude lower than that disclosed by Appellants for the claimed ion implantation and implants oxygen at an angle and over a small portion of regions 16 and 18 in comparison to Appellants' disclosed method of ion implantation for forming the claimed reduced vacancy concentration in source and drain extension regions thereof (Br. 6-16; Reply Br 2-5; Yoo, col. 4, ll. 1-41, and Figs. 2 and 3; Specification, ¶¶ 0015, 0017, 0020).

Against this backdrop, the Examiner has not furnished adequate technical reasoning or evidence to support the assertion that application of the oxygen implantation according to the method of Yoo in the AAPA would necessarily result in the claimed low vacancy regions substantially overlapping with source and drain extension regions in an upper surface of a SiGe based substrate or the claimed reduced vacancy concentration therein. After all, it is well settled that inherency may not be established by probabilities or possibilities and that the mere fact a certain thing may result from a given set of circumstances is not sufficient. *In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999); *In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981). Moreover, in relying upon the theory of inherency, the Examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art. *Ex parte Levy*, 17 USPQ2d 1461, 1464 (BPAI 1990). Weighed against the argued differences between the ion

implanting processing conditions disclosed by Appellants and the oxygen implant and processing techniques disclosed by Yoo, the Examiner's repetition of the asserted inherency of obtaining a low-vacancy concentration region outcome, as claimed, based on the combined teachings of the AAPA and Yoo, does not furnish the requisite basis in fact and/or technical reasoning sufficient to support the stated rejection. Thus, we agree with Appellants' view that the Examiner has not established the obviousness of the claimed process within the meaning of 35 U.S.C. § 103(a) predicated on the espoused inherency theory.

Moreover, and particularly concerning independent claim 38, we agree with Appellants that the Examiner has not established that Yoo discloses or suggests that the ion implanting of oxygen occurs after a gate electrode sidewall is formed on sides of a gate electrode (Br. 11; Ans. 4 and 6).

Accordingly, on this record, we reverse the Examiner's stated obviousness rejection.

ORDER

The decision of the Examiner to reject claims 16-18, 22-28, and 30-39 under 35 U.S.C. § 103(a) as being unpatentable over the AAPA in view of Yoo is reversed.

REVERSED

tf/ls

ANDREW M. CALDERON
GREENBLUM AND BERNSTEIN P.L.C.
1950 ROLAND CLARKE PLACE
RESTON, VA 20191